2nd Edition

A.P. 2097-A P.N.

PILOT'S NOTES

FOR

HORSA I GLIDER

WITH APPENDICES FOR TUG AIRCRAFT PILOTS

PROMULGATED BY ORDER OF THE AIR COUNCIL

NOTES TO USERS

This publication is divided into three parts: Descriptive, Handling, and Notes for tug aircraft pilots (with appendices for individual tug aircraft). Part I gives only a brief description of the controls with which the pilot should be acquainted.

These Notes are complementary to A.P.2095 Pilot's Notes General and assume a thorough knowledge of its contents. All pilots should be in possession of a copy of A.P.2095 (see A.M.O. A93/46).

Words in capital letters indicate the actual markings on the controls concerned.

Amendments to this publication will be issued as necessary and incorporation must be certified on the Certificate on the inside of the back cover.

Additional copies may be obtained from A.P.P.S., Fulham Road, S.W.3, by application on R.A.P. Form 894A, in duplicate, quoting the number of this publication in full - 2097A-P.N.

Comments and suggestions should be forwarded through the usual channels to the Air Ministry (D.T.P.)

HORSA I GLIDER

Part I
CONTROLS & EQUIPMENT FOR PILOTS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

PART II

HANDLING & FLYING NOTES FOR PILOT

PART III

GENERAL NOTES FOR TUG AIRCRAFT PILOTS
With Appendices for Tug Aircraft

PART I

CONTROLS AND EQUIPMENT FOR PILOTS

1. INTRODUCTORY

The Horsa I is a high-wing, monoplane glider designed for transporting 25 troops with their equipment or military equipment and light vehicles.

The main wheels of the tricycle undercarriage are jettisonable, and a landing skid protects the fuselage when making belly landings. Benches are fitted in the main cabin for the troops, and eight military equipment containers (with parachutes) are slung in cells, four on each side, under the wing. The pilot's cockpit in the nose seats two pilots side by side. Section I describes the pilot's controls and equipment, and other equipment with which the pilot should be familiar. Items of equipment shown in figs. 1 to 3 are numbered and these numbers appear in brackets in the text.

2. PNEUMATIC SYSTEM

Compressed air: Three bottles, two outboard of the starboard pilot's seat, and one on the floor across the nose, supply compressed air for operating the flaps, wheel brakes, and undercarriage jettison release. A pressure gauge (12) is fitted. When fully charged there is enough air for three complete cycles of flap operation and for subsequent normal braking on landing.

3. GLIDER CONTROLS

Primary controls are conventional and are normally interconnected by a locking pin (6) connecting two lugs (5) which projects through the front face of the well between the pilot's seats on the starboard side. To disconnect the starboard control column the locking wire should be pulled out and the pin withdrawn to the left by means of the plated tommy forming the head of the pin. The starboard handwheel can be removed by unscrewing the wing nut (18) securing it to the hub.

4. Rudder control bars (7) have toe straps and are adjustable for reach on the ground to any of five positions; they are permanently interconnected.

5. Elevator tab control: The hand-wheel (23) mounted on the left of the control pedestal, operates in the natural sense.

6. Elevator tab indicator: There is a mark on the cable drum which should be set opposite the arrow on the control pedestal for take-off.

Note: As the wheel can be rotated through approximately one full turn forward and backward from the neutral position, the take-off position should be checked by rotating the wheel back and forth about half a turn to ensure that when the mark is opposite the arrow the control is in the correct setting.

7. Flaps control: The flaps are controlled by a lever (22) working in a quadrant forming the rear face of the control pedestal. The quadrant is marked UP, 40°, and FULL DOWN and the lever should be set to these positions only. Intermediate flap settings cannot be obtained. A spring in the quadrant enables the 40° position to be selected by feel; slight pressure is required to move the lever in either direction from this setting.

8. Air brakes: The controls levers (9) extend upwards, one at each side of the control pedestal; they are interconnected and are pulled back and down to apply the brakes; spring catches with release trigger grips are fitted to retain the levers in any desired setting.

9. Wheel brakes control: A lever (2) with spring catch and release trigger grip, fitted on the port pilot's seat frame on his right, is pulled up to apply the brakes.

10. Undercarriage jettison release control: A lever (21) with a red knob shaped to represent a wheel is fitted to starboard of the flap lever. It is retained in the LOCKED position by means of a spring locking pin; to release, the pin is withdrawn and the lever pushed down.

11. Undercarriage emergency jettison control: Should the pilot's control fail to act there is a mechanical control on the aft face of No. 5 bulkhead to starboard with operating lever stowed alongside for operation by the second pilot or by one of the troops.

12. Tow release control: The two release hooks in the leading edges of the wing centre section are operated by a red lever (20) extending from the top of the control pedestal. The forward position is marked LOCKED and the rear position RELEASE.

12a. Arrester parachute controls: When installed the controls consist of a tumbler switch which is set ON to stream the parachutes, and a push-button switch for releasing them if necessary. These switches are on a panel on the port side of the cockpit and are so wired that the push-button switch is operative only when the streaming switch is ON.

13. Instruments: The following are mounted on a panel above the control pedestal: ASI (11), artificial horizon (15), rate of climb and descent indicator (16), altimeter (8) and a turn and bank indicator (17). Above this panel is a narrower board carrying the air pressure gauge (12) a flying limitations plate (13) and an adjustable panel light (14) for which a dimmer switch (32) is on the switch panel to the left of the port pilot's seat.

14. Compass: A compass (19) is mounted on a bracked extending from the starboard side of the control pedestal and a compass deviation card holder (10) is attached to the windscreen frame in line with the port pilot's wheel.

15. Mark II Tow cable angle indicator:

(i) This indicator is similar to the Mark I - HOTSPUR - type having a horizontal bar (referred to in the Instrument Manual as the horizontal pointer) which moved up and down as the position of the glider, relative to the tug, rises and falls. On the Mk II the vertical pointer, which pivots about its lower end, is connected to a gyro controlled artificial horizon unit as well as to the cable angle mechanism. It indicates true angle of bank, or cable horizontal angle variation, or a combination of both, and indicates zero whenever the correct amount of bank is being applied.

(ii) In free flight, or on tow in the 'high' tow position the cable angle measuring mechanism is out of action and the horizontal bar disappears from view at the top of the instrument. The vertical pointer continues to function, however, but being controlled by the artificial horizon mechanism only may be used in free flight to indicate angle of bank. For angles of bank in excess of 30° the response of the pointer decreases progressivgly, thus, at 90° bank, the pointer indicates 45° only.

(iii) The zero setting of the pointer is adjustable by means of the wing nut adjuster below the instrument which is turned in the opposite direction to that in which it is desired to rotate the pointer. The pointer can only be zeroed when flying in the 'low' tow position with the cable angle mechanism working.

16. Pilot's entrance: There is a door on the port side aft of the cockpit with an access ladder which is stowed in the main cabin; the door slides upwards and is secured by two latch fastenings which can be operated from inside or outside the glider. This door forms part of a larger door which opens outward about a hinge at its lower edge to form a ramp for the entry of light vehicles etc. From the main cabin the cockpit is reached through a central door in the bulkhead forming the front wall of the cabin.

17. Troop's entrance: The troops use the door on the port side as well as a similar door on the starboard side aft of the wing.

18. Seats: The pilot's seats are fixed and are provided with safety lap belts (33).

19. Hood: The plastic hood affords a wide range of vision and there are two clear vision panels (1) one on each side of the windscreen; these spring up to open and catches are provided to retain them in this position.

20. Map case: A container (31) for maps, signal index cards etc. is attached to the front of the port pilot's seat frame.

21. Loading charts: These are stowed in the main cabin about four feet aft of the cockpit bulkhead on the starboard side. On a board above this stowage are painted the tare weight, tare moment and the loading index number of the glider. Full instructions for use is given on the charts.

22. Thermos flasks: A flask for the pilots is stowed at (24) on the shelf behind and outboard of the port pilot's head. Flask and ration containers for the troops are stowed below the seat benches.

23. Sanitary equipment: A sanitary bottle for the pilots is stowed in clips on the forward face of the bulkhead outboard of the port pilot's seat back. There is also a sanitary tube for the use of the troops in the main cabin.

OPERATIONAL EQUIPMENT

24. Gun hatches: There is a hatch in the roof of the main cabin, normally covered by a fabric panel with spring catches, as well as an underbody gun hatch in the tail; these are for use by machine gunners in the event of attack.

25. Equipment container release control: The equipment containers are released by pull handles on the fuselage sides, at shoulder height, about two feet forward of the rear door line; each handle releases the group of four containers on the same side.

26. Landing flare release control: There is a flare chute underneath the port pilot's seat. The handle (1) which is pulled up to release the flare, is on the right of the port pilot's seat.

LIGHTING, RADIO & SIGNALLING EQUIPMENT

27. Radio: There is a T.R.9D set installed with a remote control unit (4) for the pilots mounted on the left of starboard pilot's seat. The head-set jack socket for the port pilot is secured to the seat frame outboard of the seat.

28. Intercommunication: The T.R.9D set provides inter-communication between the glider and tug pilots.

29. Lights: There is a fuse box (30) on the switch panel on the port fuselage side by the pilot's seat. This panel carries a morsing key unit (28) with switches for downward identification lights, a two-way switch (27) for navigation lights, a two-way switch (29) for the cabin lights and a dimmer switch (32) for the instrument panel light. To enable the cabin lights to be used at night blackout curtains for the cabin windows are stowed in a container on the port forward face of the after bulkhead in the main cabin.

30. Torches: Four electric torches are stowed in clips in the roof of the main cabin.

31. Signal pistol: For use this fits into a discharge tube projecting from the floor outboard of the port pilot's seat. Stowage for cartridges (25) is provided on the fuselage side level with the port pilot's shoulder.

EMERGENCY EXITS & EQUIPMENT

32. Parachute exits: The pilots should use the sliding door in the port side. The troops use this door as well as the door in the starboard side. The two gun hatches can also be used as parachute or crash exits should the main doors jam. To remove the main cabin gun hatch cover, pull string handles, unfasten spring catches and pull beams in.

33. First-aid kit: This is stowed on the forward face of the rear bulkhead on the starboard side below the transverse seat.

Key to fig. 1

1. Flare release control
2. Wheel brake lever
3. Clear vision panels
4. T.R.9D controls
5. Lugs connecting port & starboard control column
6. Locking pin for (5)

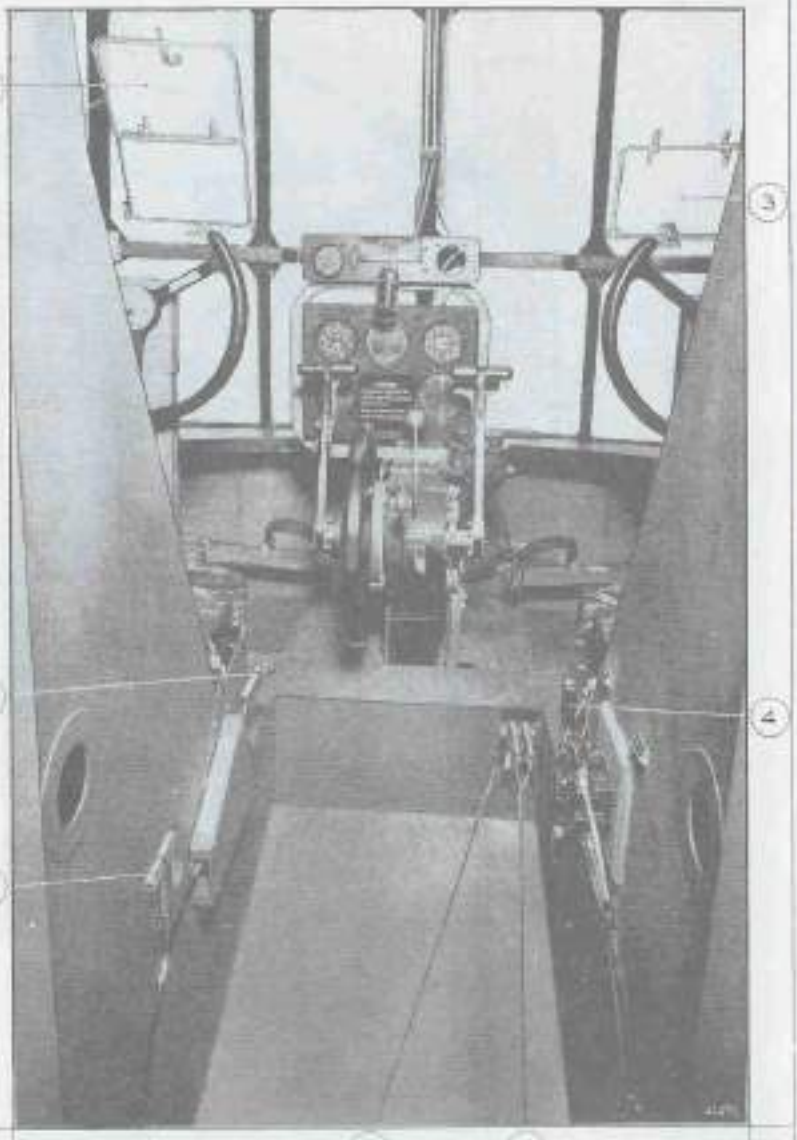

FIG 1 COCKPIT - GENERAL VIEW FIG 1

Key to fig. 2

7. Port rudder bar
8. Altimeter
9. Air brake control levers
10. Compass deviation card
11. A.S.I.
12. Air pressure gauge
13. Flying limitations plate
14. Instrument panel light
15. Artificial horizon
16. Rate of climb and descent indicator
17. Turn and bank indicator
18. Wing nut securing starboard control wheel
19. Compass
20. Tow release control lever
21. Undercarriage jettison control lever
22. Flaps control lever
23. Elevator tab control

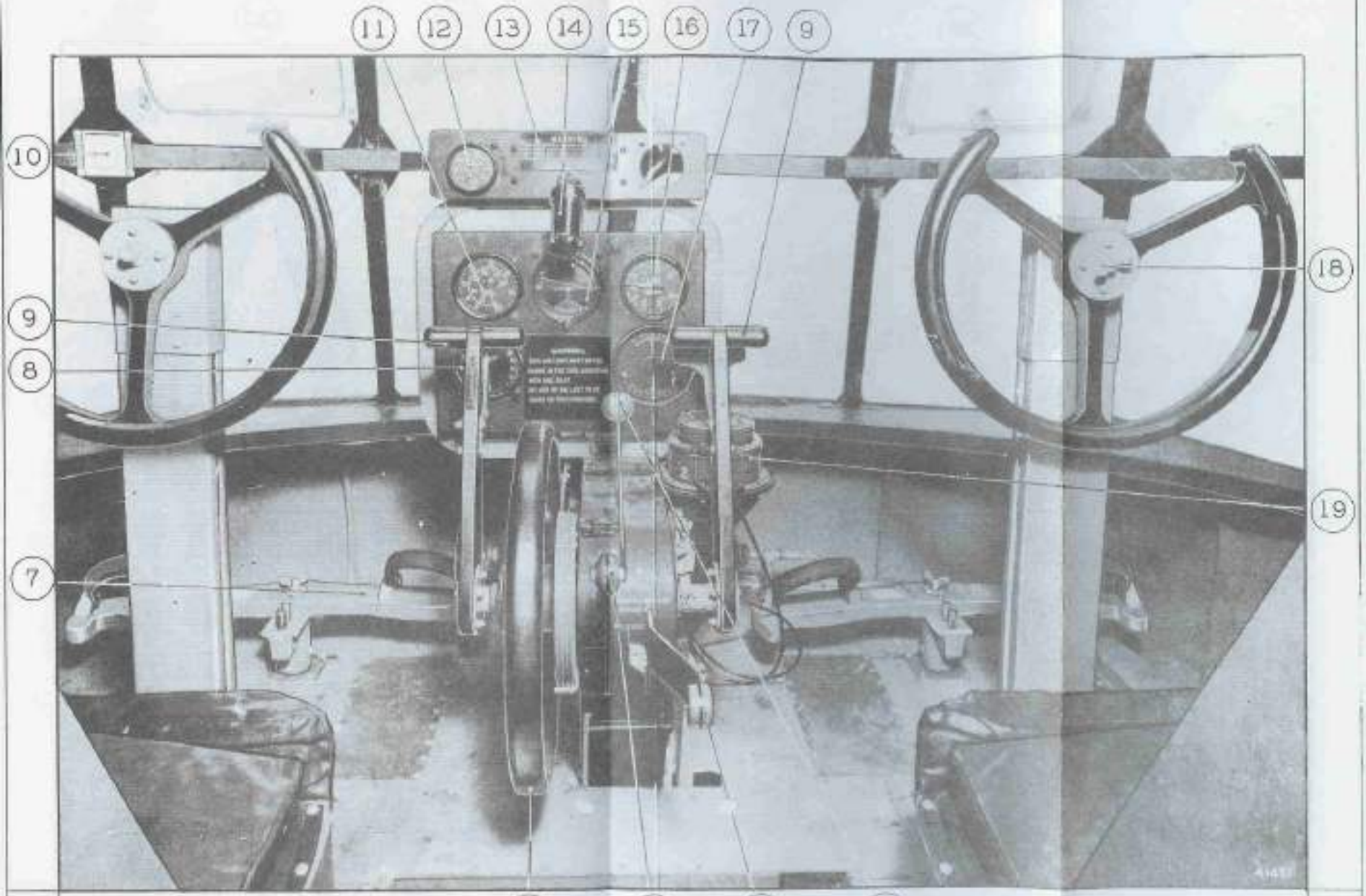

FIG. 2

INSTRUMENT PANEL AND CONTROLS

FIG 2

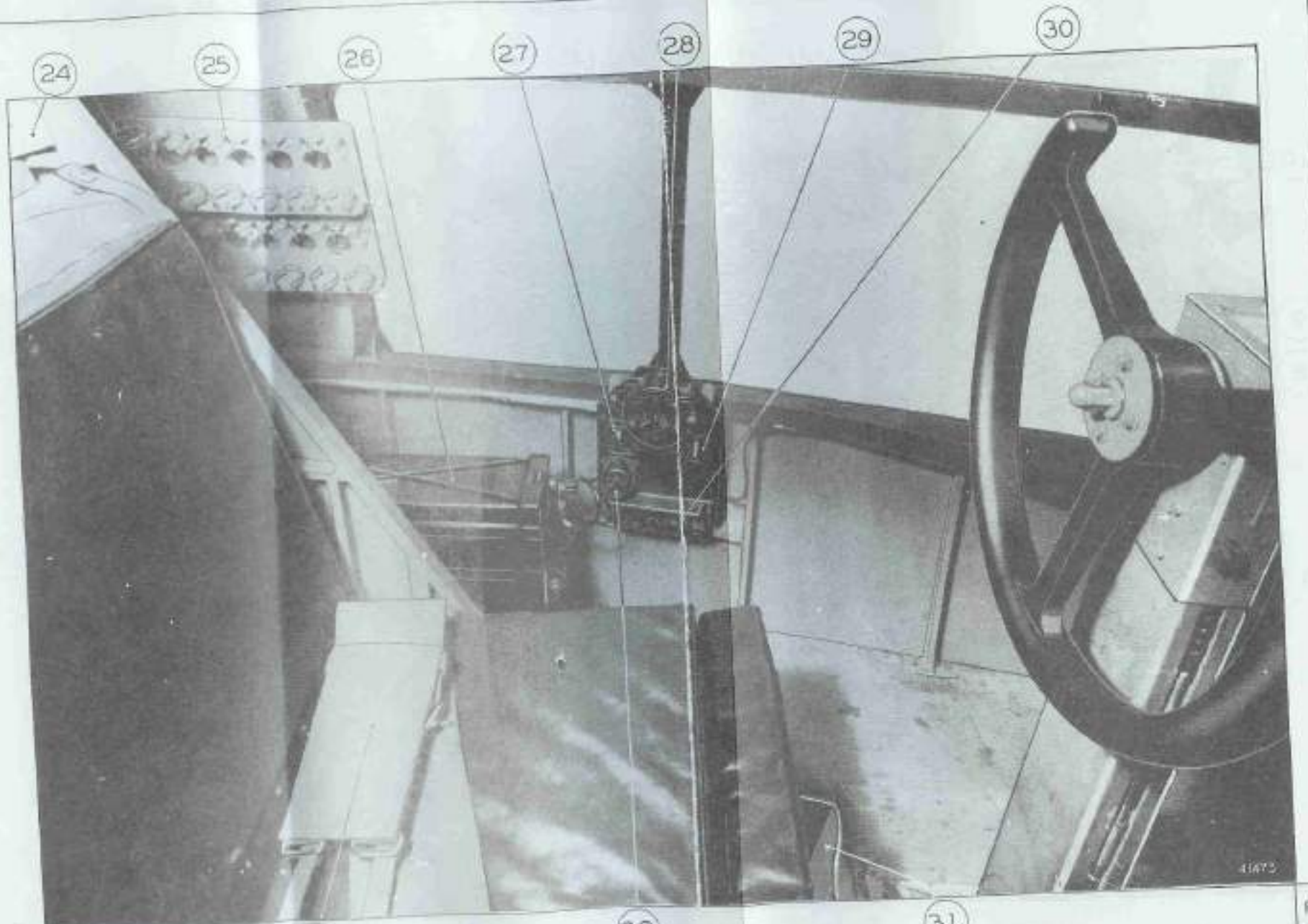

FIG. 3

COCKPIT - PORT SIDE

FIG. 3

Key to fig. 3

24. Thermos flask stowage
25. Signal cartridge stowage
26. Battery box
27. Navigation light switch
28. Morsing key & identification light switches
29. Cabin light switch
30. Fuse box
31. Map case
32. Instrument panel light switch
33. Safety belt

PART II

HANDLING AND FLYING NOTES FOR PILOTS

1. INTRODUCTION

(i) These notes are for the guidance of pilots flying Horsa glider combinations. Tug aircraft pilots should also refer to Part III and the appropriate appendix thereto covering the tug aircraft used.

(ii) The method of signalling (intercom or visual) to be used between the glider and tug pilots, both on the ground and in the air, should be agreed and the code of visual signals to be used in emergency (or if intercom is not to be used) should be in accordance with the instructions laid down by the Command concerned.

Note: It is of vital importance that glider and tug pilots shall agree and understand the code of signals to be used. The tug PILOT is CAPTAIN of the COMBINATION.

(iii) The directions in which glider and tug should turn after casting off should be in accordance with procedure laid down by the Command concerned and should be agreed by the pilots.

2. FLYING LIMITATIONS

(i) The maximum permissible weights are:

HORSA I - 15,500 lb.
HORSA II - 15,750 lb.

Weight limitations applying to specific combinations are given in the appropriate tug aircraft appendices.

(ii) Maximum permissible speeds in m.p.h. I.A.S.

Towing	160 - (150 R.A.S.)
Diving	190
Flaps half down	110
Flaps fully down	100

Note: (i) The above limitations as well as the recommended handling speeds given in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed from time to time by Special Instruction.

(ii) The Rectified Airspeed (R.A.S.) given in brackets is for the use of tug pilots in converting to tug I.A.S.

3. POSITION ERROR CORRECTION

At all speeds the correction may be taken as 10 m.p.h. to be subtracted from A.S.I. reading.

4. FITNESS OF AIRCRAFT FOR FLIGHT

Ensure that the total weight and C.G. position are within the permitted limits. Heavy loads should in no case be carried without calculating the C.G. position by means of the loading charts.

Rough guides to loading are:

(a) Two pilots, or a first pilot and ballast in the second pilot's place, should be carried.

Note: Gliders must not be flown light without a second pilot or ballast in lieu.

(b) Any load should be disposed evenly about a point one third of the chord length aft of the leading edge at the wing root.

5. PRELIMINARIES

Before entering the cockpit:

(i) See that all passengers are seated and strapped in and that the load secured. Report the all-up weight to the tug pilot.

(ii) See that the glider is directly behind the tug and on the same heading, and that the nose wheel is straight.

(iia) If arrester parachutes are fitted, see that the door of the parachute box which replaces the afterbody gun hatch is secured by the locking pin and that the release unit is fully locked. Check that the parachute static line is tied to the top of the box.

WARNING: On the Horsa II the pilot should check that the nose section locking levers are in the down (safe) position and that the lower lever is secured by the safety strap

On entering the cockpit:

(iii) Test operation of the tow release and see that the tow release control is left in the fully forward position.

(iv) See that the undercarriage jettison lever is in the correct position.

Note: On certain gliders the undercarriage is not jettisonable.

(iva) If arrester parachutes are fitted, check ON-OFF switch - OFF.

(v) Check that all air bottles are turned on, and check pressure:

(a) Minimum for training (providing the undercarriage is not to be jettisoned 150 lb./sq.in.

(b) Minimum for operational use - 2-- lb./sq.in.

(vi) If used, test inter-communication with tug. When line intercom is used the amplifier switch must be on at all times when on tow. A code of visual signals should, in any case, be agreed between the pilots for use in an emergency should the intercom fail.

(vii) Test all flying controls for full and free movement, and check that the wing nut on the starboard control wheel is secure.

(viii) See that the catches for retaining the clear vision panels in the open position operate properly.

(ix) Check that all clamps have been removed and that the elevator clamps are stowed in the cockpit.

WARNING: Keep feet clear of the aileron cable pulleys at the base of the control column.

6. PREPARATION FOR TAKE-OFF

(i) Check list before take-off

Flaps	-	UP
Air pressure	-	Minm. 150 lb. (200 lb. for operational flights)
Trim	-	Neutral (See Part 1)
Altimeter	-	Zero
Brakes	-	Off

(ii) When ready to take-off instruct pilot by intercomm to:

(a) Take up slack
(b) Take-off - when the glider starts moving.

7. TAKE-OFF

(i) Keep directly behind the tug.

(ii) At an ample margin above stalling speed (see para.14) pull off gently and hold near the ground until tug takes-off.

(iii) When the tug is clear of the ground, climb gently to maintain a 'high tow' position as defined in Para. (10).

(iv) If the Mk II indicator is to be used, allowing three minutes after take-off for the gyro to erect, zero the pointer; this should be done with the tug flying straight and the glider central below the slip-stream (the instrument only functions in the low tow position).

8. UNDERCARRIAGE JETTISON

The undercarriage should not be jettisoned at less than 200 ft. as it may bounce and hit the tail. In training conditions the undercarriage should only be dropped when authority has been given for doing this by the parachute method and should not be released at less than 200 ft. or 115 mph I.A.S. Avoid jettisoning the undercarriage if the wind speed exceeds about 10 mph as it may be damaged if it lands with much drift; practice drops over runways or other hard surfaces should be avoided.

9. CLIMBING

Keep straight behind the tug and avoid getting too high above it lest trim difficulties are introduced for the tug.

10. BEST POSITION ON TOW

To obtain the maximum rate of climb and range it is of importance that, once steady climbing conditions have been reached and in level flight, the glider shall maintain the correct position in relation to the tug flight path. Recommended positions are as follows:

(i) High Tow Position: Directly behind the tug and one half the wing span of the tug above it (with experience this position may be gauged by observing the relationship between the tug tailplane and mainplane) it is not sufficient to keep just clear of the slipstream.

(ii) Low Tow Position: Directly behind the tug and one half the wing span of the tug below it. This position is to be preferred, except during initial climb, for the following reasons:

(a) The glider tends to maintain position more naturally than in the high tow position.

(b) The correct vertical position is such that the glider is just clear of the slipstream and can therefore be more precisely gauged.

NOTE:

(i) In both high and low tow positions the glider should not be allowed to get more than one tug wing span above or below it, as otherwise cable drag becomes excessive.

(ii) The charts - Figs. 1 & 2 - show the relationship between the salient features of tug aircraft, as seen from the glider when flying in the BEST and LIMIT positions on both high and low tow. The true BEST and LIMIT positions will vary with tug loading and IAS, in particular in some conditions the LOW-BEST position as illustrated may be found to be on the edge of, or just within, the slipstream. The silhouettes, which are based on incidence angles at certain specific loadings and speeds, must therefore be taken as a general guide only. Pilots will find the most comfortable high and low tow positions by experience and, as it is tiring to maintain one position for long periods, some variation is permissible provided, generally, that the outline of the tug remains between the positions depicted by the silhouettes marked BEST and LIMIT. Reproductions of the individual tug silhouettes on cards to a larger scale are available on application to APFS, Fulham Road, London SW3 using RAF Form 294A and quoting the following references:

WHITLEY	Tow Position		Card	No. 2
HALIFAX	"	"	"	No. 3
ALBEMARLE	"	"	"	No. 4
WELLINGTON	"	"	"	No. 5
LANCASTER	"	"	"	No. 6
DAKOTA	"	"	"	No. 7
STIRLING	"	"	"	No. 8

11. LEVEL FLIGHT

(i) Small amounts of slack in the tow rope can be ignored but the control column should be eased forward slightly to prevent snatch as the slack is taken up by the tug. If the slack is appreciable it should be taken up by easing the control column slightly back until the rope is almost taut, when the column should be eased forward to minimise snatch.

(ii) On turns, keep directly behind (or slightly inside) the tug.

(iii) Cloud flying: If cloud is entered the glider pilot should release tow immediately unless a tow cable angle indicator is fitted and authority has been given for blind flying.

12. BLIND FLYING (using Mk II Tow angle indicator)

(i) On tow: Fly in low tow position; correction should be made with the elevator and ailerons assisted as necessary by rudder. Inclination of the vertical pointer indicates departure of the glider from its correct angle of bank and the pointer should be 'pushed' gently back to zero with the ailerons. As soon as the pointer reaches the zero position a touch of opposite aileron should be applied to stop the pointer moving and to prevent the glider over-shooting its correct position. This technique applies equally in level flight and when turning, climbing or descending. Movement of the horizontal bar indicates corresponding departure of the glider from its correct vertical position which should be corrected by pushing gently on the elevator control so as to push the bar back to the zero position. In rough weather some oscillation of the horizontal bar occurs (due to surging of the cable) but the vertical position of the glider is indicated by the mean of the limits of oscillation and no attempt to correct oscillation is necessary.

(ii) In free flight: The vertical pointer can be used in a similar manner to an artificial horizon to indicate angle of bank correction being applied by aileron as when on tow.

13. CASTING OFF

(i) This should be done in level flight with the glider level with or above the tug. Except in emergency do not cast off from below the tug. Speed should be at least 90 mph IAS and after casting off the tug will turn as prescribed.

(ii) With military loads stowed, the compass deviation may be considerably affected. If it is necessary for the glider to fly on a compass course after casting off, the tug should fly steadily on the required course, and should give the compass reading to the glider pilot by intercom, before release. The glider pilot should note the corresponding reading on his own compass.

(iii) If take-off is abandoned, either by the tug or by the glider pilot the rope should be released and the glider should then turn as prescribed.

14. STALLING

(i) Stalling speeds in mph IAS:

	Lightly loaded	Fully loaded
Flaps up	54	69
Flaps down	43	55

(ii) If the stall is approached quickly, or if the control column is held right back after a slow approach, one wing may drop gently.

15. GLIDING

(i) The following speeds in mph IAS, (with undercarriage) are recommended:

	Light	Heavy
Flaps up	70	85
Flaps half down	65	75

(ii) With flaps fully down the glide path is extremely steep. Flaps can be raised to the half down position without appreciable sink; it is not necessary to increase speed.

16. APPROACH AND LANDING

(i) Up to half flap may be used on the cross wind approach to regulate height.

(ii) Make the final turn towards the landing ground with half flap and when sure of getting into the landing ground, lower the flaps fully.

(iii) The glide path with flaps fully down is steep, and care is necessary, especially in strong winds, not to get too far downwind. Flaps may be raised to the half down position if undershooting but it must be remembered that response is slow. Flaps must not be raised fully at normal flaps down approach speeds, and even if speed is increased in order to raise them fully, this will not correct undershooting at this stage of the approach.

(iv) Recommended speeds for final straight approach, with flaps fully down are:

Light 60 mph IAS
Heavy 75 to 80 mph IAS

(v) Flatten out and land on the main wheels in a slightly tail down attitude, lower the aircraft gently onto the nose wheel and then, when all three wheels are on the ground, apply brakes.
Note: the brake action is not differential.

(vi) Landing technique using arrester parachutes: The approach is made normally at speeds up to 100 mph IAS. At about 50 feet operate the tumber switch and immediately begin to level out. (There is a three second delay between the operation of the switch and the opening of the parachutes).

When the parachutes open there is a slight tendency for the nose to drop which can be corrected by the use of elevator. As the glider drops on to the ground suddenly after the parachutes have opened, do not hold off higher than 30 feet.

WARNING: If the parachutes stream prematurely either on or off tow, both the tumbler switch and the jettison button must be operated immediately as the action of the parachutes is to cause the glider to stall suddenly.

17. AFTER LANDING

(i) Raise flaps.

(ii) When being towed down-wind, controls should be held central, or if the glider is not occupied all control surfaces and the flaps must be locked.

(iii) Park facing into wind with controls and flaps locked.

18. EMERGENCIES

(i) Although the tug pilot is CAPTAIN of the combination the glider pilot may, in emergency, cast off and take other action on his own initiative; he should, however, warn the tug pilot first if possible.

(ii) Abandoning tow before tug is airborne: The glider pilot should release tow, first if possible, should land (if airborne) apply his brakes and turn as necessary.

(iii) Engine failure on take-off after tug is airborne: If warned in time the glider pilot should release tow first and land straight ahead. He may make partial turns to avoid the tug or other obstacles but in no circumstances should he attempt to turn back to the airfield. Unless there is ample room for a normal landing the undercarriage should, if possible, be jettisoned.

(iv) Failure of towing hook or bridle: Should the hook or bridle on one side fail, there is no need to cast off. Position on tow can be maintained and turns executed without difficulty as follows:

(a) By using the ailerons only. Rudder need only be used to check the initial yaw and until the glider takes up a position such that the cable is in line dead behind the tug, the glider flying slightly to the side away from that on which the cable remains attached.

(b) An alternative position is dead behind the tug and in line with it; this can be maintained by holding on a little aileron to fly slightly wing down towards the side on which the cable remains attached.

19. DITCHING

See A.P. 2095 and note: The pilot's roof hatch (if fitted) should be opened as soon as a ditching is decided upon. If no pilot's roof hatch is fitted, one or more hood panels should be broken out with any available instrument. If passengers are being carried they should open the upper gun hatch cover and make preparations for breaking out additional exits in accordance with the drills set out in A.D.3913 and A.D.3913A. No attempt should be made to break out exits except at former Nos. 3 and 15 which are painted red, and, after alighting, at the adjacent skin areas which are painted yellow. The undercarriage causes violent deceleration and diving so that, if still in place, it should be jettisoned. The flaps increase rate of descent and nose down attitude, but they may be lowered to the 40° position to reduce forward speed, provided that visibility is good and the pilot feels confident of judging height accurately enough to flatten out in time to prevent the impact being taken by the nose.

On impact, although the deceleration should not be severe, the lower part of the nose is almost certain to break in and the fuselage will rapidly fill to wing level, after which the wings should keep the glider afloat for a considerable time.

Warning:

For all flights, whether training or operational, involving flying over the sea, the undercarriage ground locking device should be left unlocked to enable the pilot to jettison the undercarriage should a ditching become necessary.

20. REMOVAL OF TAIL SECTION - For quick unloading of cargo.

The pilot should be familiar with the procedure for rapid removal of the tail section; he should also ensure that the crew know the drill for doing this as laid down in A.P.2453D, Vol. I, Part 3, Sect. 1.

A.P. 2097-A, P.N. — TOW POSITION CHART — P.N., PART II

HIGH TOW


HIGH LIMIT


HIGH BEST


HIGH LIMIT


HIGH BEST


HIGH LIMIT


HIGH BEST


HIGH LIMIT


HIGH BEST

WHITLEY | HALIFAX | ALBEMARLE | WELLINGTON

LOW TOW


LOW BEST


LOW LIMIT


LOW BEST


LOW LIMIT


LOW BEST


LOW LIMIT


LOW BEST


LOW LIMIT

1. When flying in the best positions on HIGH (or LOW) TOW, the tug aircraft should appear as shown in the silhouettes marked HIGH (or LOW) BEST

2. The glider should not be allowed to get above (or below) the positions in which the tug aircraft appears as shown in the silhouettes marked HIGH (or LOW) LIMIT.

FIG. 1

F.S./S

FIG. 1

A.P.2097-A, P.N.

TOW POSITION CHART

P.N., PART II

HIGH TOW

DAKOTA

LANCASTER

STIRLING

RESERVED FOR ADDITIONAL TUG

LOW TOW

DAKOTA

LANCASTER

STIRLING

1. WHEN FLYING IN THE BEST POSITIONS ON HIGH (OR LOW) TOW, THE TUG AIRCRAFT SHOULD APPEAR AS SHOWN IN THE SILHOUETTES MARKED HIGH (OR LOW) BEST.
2. THE GLIDER SHOULD NOT BE ALLOWED TO GET ABOVE (OR BELOW) THE POSITIONS IN WHICH THE TUG AIRCRAFT APPEARS AS SHOWN IN THE SILHOUETTES MARKED HIGH (OR LOW) LIMIT.

FIG. 2

FIG. 2

PART III

GENERAL NOTES FOR TUG AIRCRAFT PILOTS

All normal limitations and handling recommendations in Pilot's Notes for individual tug aircraft should be observed as modified and added to, by the instructions contained in these notes, as well as in the appropriate appendix covering the particular Tug aircraft to be used. These appendices apply only to those Marks of the respective aircraft which have been formally released for towing the particular gliders.

1. GENERAL

(i) When towing a glider the general performance will not be as good as that of the tug in normal free flight. This calls for care on the part of the pilots, particularly during and after take-off, and on the initial climb. Care is also necessary to avoid overheating the engines.

(ii) The method of signalling and code of visual signals to be used in emergency (or if intercom is not fitted) must be agreed with the glider pilot. The TUG AIRCRAFT PILOT is at all times CAPTAIN of the COMBINATION but glider pilots may in emergency, or if cloud is entered, cast off and take other action on their own initiative; if possible, they should, however, warn the tug pilot first.

(iii) The direction in which glider and tug will turn after casting off should be agreed between the pilots.

2. LIMITATIONS

(i) Weight: Combinations are cleared to fly at specified maximum weights; these are quoted in the appropriate tug appendices.

(ii) Speed: Speed limitations are quoted in the appropriate appendices in terms of tug and glider ASI readings. Where however, temporary speed restrictions are in force for the glider, the tug pilot shall ascertain the corresponding speed in terms of the tug aircraft ASI reading, as follows:

Correct the glider limiting IAS for position error. This gives speed limitation in terms of rectified airspeed (RAS).

Apply to this RAS figure the appropriate tug position-error correction reversed, i.e. if the pec. is plus, subtract and vice versa.

(iii) Engine limitations: Unless otherwise specified in the appropriate appendix the normal limitations for the type should be observed.

3. PRELIMINARIES

(i) The tug pilot as CAPTAIN of the combination should check that aircraft weights are in accordance with limitations and that the state of both aircraft, and distribution of loads, are in accordance with any special conditions specified in the combination release.

(ii) To avoid overheating during take-off and climbing, run the engines as little as possible on the ground. If, after reaching the take-off point, take-off is delayed, engines should be stopped. A ground battery should be at the take-off point for restarting.

(iii) Check position of glider.

(iv) Check that the rope is properly attached, test quick release, re-attach rope making sure that the hook is locked, and that the release control is in the locked position. If the hook is attached to a towing yoke, check that this is unlocked.

(v) After agreeing the code of visual signals with the glider pilot or pilots, test the intercom. (if to be used) with glider with engines running. +With line intercom. the switch must be set to MIX or held to LINE at all times with a glider in tow.

4. TAKE-OFF

(i) Checks before take-off:

(a) CHECK LIST - See appropriate appendix.

Note: The trim for take-off recommended may vary with tug loading and is given as a guide only.

(b) Except in very cool weather, and when experience indicates that temperature limitations will not be exceeded on climb, do not take-off if the engine temperatures are in excess of any recommended in the appropriate appendix.

(c) Clear engines before take-off: this is essential if ground running has been protracted.

(ii) Taking-off

Note: It is advisable to have a member of the crew available to operate the tow release if it becomes necessary to abandon tow during take-off. It is recommended that the same member of the crew be detailed for this duty on each take-off, as good co-operation is important.

(a) When ready, the glider pilot will give the signal 'Take up slack'.

(b) To avoid taking up slack too suddenly the engines may be opened up slowly against the brakes which should be released progressively to allow the tug to move forward slowly and steadily. The glider pilot will signal 'Take-off' when the glider begins to move, and the tug pilot should then open up without hesitation to ensure that the rope does not go slack and the glider overrun it.

(c) Any tendency to swing should be checked promptly before it is communicated to the glider.

(d) Ease the tug off the ground and raise undercarriage and flaps (if used) in accordance with recommendations in the appropriate appendix.
NOTE: It will usually be necessary to retrim after raising the undercarriage and flaps, the exact setting depends upon the tug weight and c.g. position, as well as upon the glider weight and position relative to the tug (the higher it flies, the greater the tail 'up' pull on the tug, and no exact settings can be quoted.

5. CLIMBING

(i) Climb steadily at the speed recommended in the appropriate appendix. If the recommended speed is below the safety speed of the aircraft the pilot should, in the event of engine failure before a safe height is reached, warn the glider pilot (if possible) release tow, shut throttles and make the best landing possible.

(ii) Use maximum climbing boost and rpm.

(iii) Oil cooler shutters (if not automatic) and gills (or radiator shutters, if not automatic) should be adjusted as necessary; gills should, however, not be open beyond the setting recommended in the appropriate appendix, as otherwise the drag is excessive.

(ix) (a) If oil and/or cylinder (or coolant) temperatures approach limitations increase IAS to the speed recommended in the appropriate appendix.

(b) If overheating is still experienced reduce rpm as recommdned but maintain the same increased IAS unless any other speed is specifically recommended in the appropriate appendix.

NOTE: These measures will reduce rate of climb and ceiling.

6. CRUISING

(i) The combination may be flown at the highest speed which can be maintained using maximum cruising power provided that the maximum permitted towing speed is not exceeded.

(ii) The relevant appendices quote an IAS recommended for maximum range and for use if engine temperatures exceed limitations when flying at a higher speed (this speed is also the minimum comfortable speed at which the combination can be flown for long periods). To fly at the above IAS use weak mixture (except when this is not possible - see (iv) and the highest obtainable boost (not exceeding the maximum permitted for weak mixture cruising) adjusting the rpm, which may be as low as practicable, as necessary.

(iii) Adjust oil cooler and radiator shutters (if non automatic) or gills as necessary. Gills should, however, not be opened beyond the settings recommended in the relevant appendices.

(iv) If the recommended IAS cannot be maintained at the required operational height at maximum weak mixture power, or if, when flying at the recommended IAS, the engines still overheat, change to rich mixture (if a mixture control is fitted), and on all British engines (for American engines see NOTE) increase to the highest obtainable boost (not exceeding the maximum permitted for rich mixture cruising) adjusting rpm which may be as low as practicable, to give the recommended IAS. In those cases where these measures may be necessary the relevant appendices will include a note to this effect. In certain cases better cooling in rich mixture may be obtained by flying at a higher speed than that recommended for maximum range - When this applies the relevant appendices give full details.

NOTE: With American engines, minimum rpm restrictions apply when cruising at boosts in excess of the maximum permitted in weak mixture. It is, therefore, necessary to use a combination of the highest boost and lowest rpm (within the limits set out in tabular form for the individual engines in the appropriate appendices) which will give the recommended IAS. This may be done as follows:

(a) Set rpm to the highest permitted for rich mixture cruising.

(b) Adjust boost until flying slightly faster than the recommended IAS.

(c) Then reduce rpm as necessary.

(d) If it is then found that the combination of boost and rpm is not in accordance with the table, both boost and rpm should be adjusted until the best combination (i.e. highest boost and lowest rpm permitted), which gives the required IAS, is found.

(v) The use of rich mixture results in loss of range so that (unless rich mixture is being used because temperatures cannot be maintained within limitations in weak mixture) as fuel is used and weight is reduced sufficiently to enab the recommended IAS to be maintained at maximum weak mixtu power, a change to weak mixture boost and rpm (and to weak mixture if a control is fitted) should be made.

(vi) Turns should be commenced gradually and at the recommended cruising speed should not be allowed to exceed rate 1. At higher speeds, up to the maximum permitted, turns up to rate 1½, or rate 2 in emergency, are practicable.

(vii) Descent on tow:

(a) Maintain rpm as set for level flight and adjust throttles to maintain a steady I.A.S. about 10 to 15 mph below the maximum permitted, with a rate of descent not exceeding 800 ft. per min. The use of partial flap may be found to assist.

(b) Radiator shutters or gills, and oil cooler shutters (if adjustable) should be adjusted as necessary.

(c) Recovery should be gradual, throttles being opened slightly to maintain speed.

(viii) Flying in cloudy weather: Avoid flying into cloud; if it is unavoidable, the glider pilot will cast off (unless a tow cable angle indicator is fitted and authority for blin flying has been given).

7. CASTING OFF

The tug pilot will give the order to cast off and should n (except in emergency release until the glider has done so. The tug pilot should avoid getting in the way of the glide After casting off retrim as necessary. No precise setting can be recommended for the reasons given in the note to par. 4(ii)(d).

NOTE: Should the glider require to fly on a compass cours after release, a special compass check may be necessary - see part II, para 13.

8. DROPPING THE ROPE

Under training conditions fly upwind at about 400 ft. and release the rope over the rope dropping area. If a towing yoke is fitted the pilot should instruct crew to lock it.

9. EMERGENCIES

(i) Abandoning tow before tug is airborne: Unless necessary t tug pilot should not release until after the glider pilot.

He will then throttle back and apply brakes. The glider will cast off, apply brakes and turn as necessary to avoid the tug.

(ii) Engine failure on take-off after tug is airborne: If possible the glider pilot should be warned so that he may release tow at his end first. The tug pilot will in any case release tow and will then take normal action disregarding the glider. If the tug has to land the glider pilot will turn as necessary.

(iii) Take-off abandoned by the glider: If theglider pilot decides to abandon the take-off and release the tow, the tug pilot should also release.

(iv) Engine failure in flight:

(a) In the event of engine failure, before deciding to abandon tow, the tug pilot should instruct the glider pilot to jettison the undercarriage as well as any items of loose equipment possible; he should also jettison any loose equipment in the tug and as much fuel as practicable.

(b) If height cannot be maintained and the tug pilot decides to release the glider, he should warn the glider pilot who should release first if possible, or in any case immediately after the tug release.

(c) If the rudder has been trimmed for no load with the dead engine, the change of rudder trim will be considerable after releasing the glider. This should be trimmed out as speed is gained.

On four-engined aircraft if the tow is being continued after engine failure apply the appropriate trim. Before releasing the glider it is then essential to return rudder trim to neutral by throttling back on the opposite engine.

NOTE: See also appropriate appendix as follows:

Tug	Appendix
WHITLEY	I
HALIFAX	II
ALBEMARLE	III
WELLINGTON	IV
LANCASTER	V
DAKOTA (C.47)	VI
STIRLING	VII
HUDSON	VIII

APPENDIX I

Notes for WHITLEY tug aircraft Pilots when towing HORSA I GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are:

HORSA	15,500 lb.
WHITLEY	23,000 lb.

(ii) Maximum speeds:

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	142	160

NOTE: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - see Part III

(ii) Check glider stationing, towing yoke unlocked, test quick release (this is lever on the starboard side which is pulled towards the pilot to release), agree code of signals and test intercom. - see Part III.

(iii) Check that the rear turret guns are central and elevated at least 10°.

4. CHECKS BEFORE TAKE-OFF

(i) Set Flaps - - UP (to 10° at full weights if take-off run is restricted)

Trim - Elevator -) Neutral
Ailerons -)
Rudder - 1½ divisions starboard

Boost control cut-out - Pulled

Radiator shutters - Fully open

(ii) The recommended maximum temperatures for take-off are:

Coolant - 80°C
Oil - 85°C

5. TAKE-OFF

(i) Ease the tug off at about 85 mph IAS

(ii) Fly level until a speed of 95/100 mph IAS is reached.

(iii) As soon as safely airborne raise the undercarriage and then flaps (if down) and reduce power to climbing boost and rpm to prevent overheating.

6. CLIMB

(i) The recommended speed for best climb is between 100 and 105 mph IAS.

(ii) If engines overheat increase speed to 110/115 mph IAS.

7. CRUISING

(i) The recommended speed for maximum range and for cooling if engines overheat at a higher speed is 105/110 mph IAS.

(ii) Rich mixture power may be required for cooling in hot weather.

(iii) Warning: With the glider flying high the rear turret cannot be rotated as it may foul the yoke should this rise above the horizontal. The yoke may also foul the guns if, when central, their elevation is less than 10°.

8. TURNS, DESCENT ON TOW, CASTING OFF AND ROPE DROPPING

See Part III

9. AFTER DROPPING ROPE

Check with crew that towing yoke is locked. With the yoke locked turret and guns can be used normally.

10. EMERGENCIES

See Part III

APPENDIX II

Notes for HALIFAX tug aircraft Pilots when towing HORSA I GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are

HORSA	15,500 lb.
HALIFAX II	47,000 lb.
HALIFAX V	54,300 lb.

(ii) Maximum permissible speeds are:

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	140	160

Note: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - see Part III

(ii) Check glider stationing, test quick release, (this is a 'pull' handle on the right of the throttle box; it is pulled to release), agree code of signals and test intercom. - See Part III.

4. CHECK BEFORE TAKE-OFF

Set - Flaps - 15° Heavy (20° to 25° Light)
Trim - Rudder) - Neutral
Ailerons)
Elevator - 1½ divisions back
Radiator shutters - Fully open

5. TAKE-OFF

(i) At 95 to 100 mph IAS ease the tug off.

(ii) Fly level until a speed of 115 to 120 mph IAS is reached (This is below the safety speed - See Part III.)

(iii) Raise the undercarriage as soon as safely airborne.

(iv) Maintain take-off power until the flaps are up; they should not be raised below 200 ft. (500 ft. on the Halifax V). The flaps should, if possible, be raised in stages by selecting flaps UP and at once returning the control to NEUTRAL, repeating the operation several times. If flaps are raised quickly the aircraft will sink but at 200 ft. (or 500 ft.) this is not dangerous.

6. CLIMBING

(i) The speed recommended for best climb is 120 mph IAS.

(ii) If engines overheat, speed may be increased to 125 mph IAS; rate of climb should still be adequate. No reduction of rpm should be necessary.

7. CRUISING

The recommended speed for maximum range and for cooling if engines overheat at a higher speed is 120 to 125.

8. TURNS, DESCENTS ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES - See Part III.

APPENDIX III

Notes for ALBEMARLE tug aircraft Pilots when towing HORSA I GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are

HORSA	15,500 lb.
ALBEMARLE	31,200 lb.

(ii) Maximum permissible speeds are:

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	145	160

Note: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instructions.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - See Part III.

(ii) Check glider stationing, test quick release (this is a pull knob on the right of the throttle box; it is pulled to release), agree code of signals and test intercom. - See Part III.

(iii) The recommended maximum temperatures before take-off are:

Cylinder - 190°C
Oil - 60°C

4. CHECKS BEFORE TAKE-OFF

Set Flaps - 25°
Trim
Elevator - 2 to 4 divisions back
Rudder - neutral
Gills - 1/2 open (to marks on air intake)

5. TAKE-OFF

(i) Ease the tug off at:

(a) Operational weights - 100 mph IAS
(b) Reduced weights - 90 to 95 mph IAS

5. TAKE-OFF

(i) At 85 mph IAS (80 at reduced loads) ease the tug off, trimming back as necessary.

(ii) Fly level until a speed of 100 mph IAS is reached. This is below safety speed - see Part III, para 5.

(iii) As soon as safely airborne raise the undercarriage and reduce to climbing power.

6. CLIMB

(i) Retrim back as necessary.

(ii) The recommended speed for best climb is 105 mph IAS.

(iii) If engines overheat increase speed to 110/120 mph IAS. Rate of climb at operational weights will be considerably reduced if speed is further increased, or rpm reduced.

7. CRUISING

(i) The recommended speed for maximum range and for cooling if engine overheat at a higher speed is 108 to 113 mph IAS.

(ii) Rich mixture power may be required to maintain height and/or for cooling in hot weather.

(iii) Warning: With the glider flying high the rear turret cannot be rotated as it may foul the yoke should this rise above the horizontal. The yoke may also foul the guns if, when central, their elevation is less than 10°.

8. TURNS, DESCENT ON TOW, CASTING OFF AND ROPE DROPPING
See Part III.

9. AFTER DROPPING ROPE

Check with crew that towing yoke is locked. With the yoke locked turret and gun can be used normally.

10. EMERGENCIES - Part III.

APPENDIX V

Notes for LANCASTER tug aircraft Pilots when towing HORSA I & II GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are:

	Normal Operational	Extended Load
HORSA I	15,500 lb.	
HORSA II	15,750 lb.	
LANCASTER I & III	47,000 lb.	57,500 lb.
LANCASTER II	48,100 lb.	61,350 lb. *

* Restricted to 58,000 lb. in tropical conditions

(ii) Maximum permissible speeds are:

	Reading in mph	
	On Tug ASI	On Glider ASI
Towing	150(140)	160

Note:
(a) The tug speeds (not in brackets) quoted above and throughout this appendix apply with the ASI connected to the static vent. The speeds quoted in brackets are for use when the ASI is not connected to the static vent.

(b) All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - See Part III.

(ii) Check glider stationing, test quick release (The control is a red toggle labelled GLIDER RELEASE mounted on the floor aft of the throttle box; it is pulled up to release), agree code of signals and test intercom. - see Part III.

4. CHECK BEFORE TAKE-OFF

Set - Flaps	- 15° (to 25° at light loads)
Trim - Rudder) Ailerons) Elevator)	- Normal
LANC (Radiator shutters 1 & III	- Fully open (by means of ma override switch); they shou be left so set (except in v cool weather) at all time a glider on tow.
LANC II (Gills	- 1/3 open
(Oil cooler shutters (preset)	- 3/5 open (in hot weather it may be found necessary to set 4/5 open to preve excessive oil temperature rise during ground running).

5. TAKE-OFF

(i) At normal operational loads, ease the tug off at 95 (90) mph ASI. At extended loads, an increase in take-off speeds is necessary, on the Lancaster I or III at 57,500 lb. to 105 mp ASI and on Lancaster II at 61,350 lb. to 115 mph.

(ii) After take-off, speed must be allowed to increase by 15 to 20 mph before commencing to climb (this will be below safety speed - See Part III).

(iii) Raise the undercarriage as soon as safely airborne and maintain take-off power until a height of not less than 100 is reached; reduce to climbing power and then raise the flaps in stages.

6. CLIMBING

(i) The speed recommended for best climb is 125 to 130 mph IAS at normal operational loads. At extended loads an increase in climbing speed to 145 to 150 mph IAS is recommended. On Lancaster I or III at extended load, in cool weather, a bet rate of climb is obtainable by climbing at 140 to 145 mph IA provided excessive engine temperatures arenot experienced.

(ii) On the Lancaster II gills may be opened fully if temperature rise excessively.

(iii) There should be no necessity to increase speed or to reduce rpm for cooling except on the Lancaster III at extended loa in hot weather when the climbing speed should be increased to 150 mph IAS.

7. CRUISING

(i) The speed recommended for cruising at normal operational loads is 125 to 130 mph IAS
(120) (125)
At extended load (61,350 lb. on LANC II) the speed is increased to 130 to 135 mph IAS and proportionally
(125) (130)
at intermediate loads with either Lanc. I, II or III.

(ii) On Lancaster II
Gills - as for climbing

(iii) Rich mixture power may be required to maintain height at full operational loads in very hot weather.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES - See Part III.

APPENDIX VI

Notes for DAKOTA (C47, C47A & C53) tug aircraft Pilots when towing HORSA I GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are:

DAKOTA	26,000 lb.
HORSA	15,500 lb.

(ii) Maximum speeds:

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	145	160

Note: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed but the following concession is permitted for use when towing a glider only.

	Boost	rpm	temp.cylr.
RICH MIXTURE CRUISING	39 ins	2450	250°C

Note: At the following boosts, rpm must not be reduced below the figures quoted.

At Boost	Min. rpm
39 ins. Hg.	2350
37 " "	2250
35 " "	2150
33 " "	2050

Below this change to AUTO-WEAK unless this causes overheating.

Note: It is suggested that the above table be copied on a suitable card for easy reference in flight.

3. PRELIMINARIES

(i) Check the glider stationing, test the quick release (this is a knob on the bulkhead behind the second pilot's shoulder; it is operated by the SECOND PILOT and is pulled to release), agree code of signals and test intercom.

Note: Certain C47 and C47A and C53 aircraft have the towing hook mounted externally. With this fitting angular displacement of the glider relative to the tug should be limited to 25 degrees up, 20 degrees down, and 20 degrees either side to prevent damage to the hook mounting. When this applies the tug pilot as CAPTAIN of the combination should impress upon the glider pilot the advisability of following as closely as possible (consistent with maintaining best towing position - see Part II para. 10) the line of the tug flight path.

(ii) When operating at high weights in hot weather the recommended maximum temperatures for take-off are:

Cylinder - 200°C
Oil - 55°C

4. CHECKS BEFORE TAKE-OFF

Set - Flaps - Nill to 15° (Nill at 26,000 lb)

Trim
- Rudder & Ailerons - Neutral
- Elevator - 2 divisions back

Oil cooler flaps - Fully open

Gills - TRAIL (May be fully open in hot weather if experience indicates necessity - but see para. 6(ii).

5. TAKE-OFF

(i) Ease the aircraft off at 90 to 95 mph IAS.

(ii) Do not commence to climb until a speed of 95/100 mph IAS is reached. This is below the safety speed - see Part III para 5.

(iii) Raise the undercarriage as soon as safely airborne, and then, at a safe height, flaps (if down).

6. CLIMBING

(i) The speed recommended for best climb is 105/110 mph IAS.

(ii) Gills should not be opened beyond the TRAIL position unless temperatures rise excessively, when they may be fully opened; some buffeting may be experienced.

(iii) If engines still overheat, increase to 120/125 mph IAS. At full operational weights rate of climb will be considerably reduced if speed is increased above this or rpm reduced.

7. CRUISING

(i) The speed recommended for maximum range is 110 to 115 mph IAS.

(ii) Gills - as for climbing.

(iii) Rich mixture power may be required to maintain the recommended speed, and in very hot weather for cooling. In rich mixture better cooling may be obtained by flying at a higher speed than that recommended for maximum range; this should be done by increasing rpm and boost progressively, until satisfactory cooling is obtained. Speed should not be increased more than is essential for cooling as range is reduced at high speeds. In weak mixture no improvement in cooling should be obtained by flying faster than the speed recommended for maximum range. See Part III, para. 5(iv) and para. 2 of this Appendix.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES - See Part III.

Note that on casting off there is some change of trim to tail heavy.

APPENDIX VII

Notes for STIRLING TUG AIRCRAFT Pilots when towing HORSA I GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are:

HORSA	15,500 lb.	
STIRLING	55,500 lb.	
STIRLING III	56,600 lb.	
STIRLING IV	59,900 lb.	
	(58,000 lb.	in tropical conditions)

(ii) Maximum permissible speeds are:

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	150	160

Note: All limitations and handling speed quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed.

3. PRELIMINARIES

(i) Check weights and fitness of aircraft for flight - see Part II

(ii) Check oil cooler shutters - preset, inner - open
outer - 2/3 open

(iii) Check glider stationing, test quick release (this is a long lever on the right of the throttle box: it is pulled to release), agree code of signals and test intercom. - See Part III.

(iv) The recommended maximum temperatures before take-off are:

Cylinder 180°C
Oil 65°C

4. CHECKS BEFORE TAKE-OFF

Set Flaps - 1/3 out
Trim
Elevator - 3 divisions forward
Rudder - neutral
Gills - 1/3 open

5. TAKE-OFF

(i) As speed is gained, trim elevator back as necessary and ease the tug off at about 95/100 mph IAS.

(ii) Fly level and close to the ground until a speed of 120 mph IAS is reached. At tug weights of over 56,000 lb. a shorter take-off run can be obtained by commencing to climb at 110 mph IAS but it must be remembered that this is very much better below the tug safety speed - see Part III para. 5.

(iii) Raise the undercarriage, as soon as safely airborne and reduce to climbing power as the wheels come up.

(iv) Raise flaps and retrim as necessary. With the glider flying in the high tow position considerable tail down trim will be required.

6. CLIMBING

(i) The speed recommended for best climb is 130/135 mph IAS.

(ii) Gills should not be opened beyond the 2/3 open position.

(iii) If overheating is experienced, increase to 135 to 140 mph IAS. In hot weather it may also be necessary to reduce rpm (in particular on the inner engines) by 100 rpm.

7. CRUISING

(i) Retrim elevator as necessary - See para. 5(iv).

(ii) The speed recommended for maximum range is 130/135 mph IAS.

(iii) Gills should not be opened beyond the 2/3 open position.

(iv) Rich mixture power may be required to maintain height and in hot weather for cooling, at full operational loads.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES

See Part III.

APPENDIX VIII

Notes for HUDSON tug aircraft Pilots when towing HORSA I GLIDERS.

1. FLYING LIMITATIONS

(i) Maximum permissible weights are:

HUDSON	16,700 lb.
HORSA	15,250 lb.

(ii) Maximum speeds:

	Readings in mph	
	On Tug ASI	On Glider ASI
Towing	145 (125 knots)	160

Note: All limitations and handling speeds quoted in these notes are subject to any temporary restrictions which may be in force at the date of issue, or which may be imposed subsequently from time to time by Special Instruction.

2. ENGINE LIMITATIONS

The normal limitations should be observed but the following concession is permitted for use when towing a glider only.

	Boost	rpm
RICH MIXTURE CRUISING (IN M GEAR ONLY)	37.5	2300

Note: At the following boosts rpm must not be reduced below the figures quoted.

At Boost	Min. rpm
37.5 ins. Hg.	2300
35.5 " "	2200
33.5 " "	2100
31.5 " "	2000

Below this change to AUTO-WEAK unless this causes overheating.

Note: It is suggested that this table be copied onto a suitable card for quick reference in flight.

3. PRELIMINARIES

(i) See that the turret and all items of removable equipment as recommended in the DTD release have been removed and that fuel and ballast are carried in accordance with the further provisions thereof. Check weights and fitness of both aircraft for flight - See Part III.

(ii) Check the glider stationing, test the quick release (The control is a lever mounted above the pilot's electrical control panel. With the lever in the fully forward position the towing hook is locked and when pulled back, pressing the trigger knob to release catch, the tow rope is released), agree code of signals and test intercom.

Note: Certain of these aircraft may have this lever labelled FORWARD TO RELEASE - BACK TO JETTISON. This label should be removed and, in any case, should be disregarded as it refers to the operation of the tail parachute and not to glider towing.

4. CHECKS BEFORE TAKE-OFF

Set - Flaps	- Nil to 15°	
Trim	- all tabs	- Normal
Oil cooler flaps		- Fully open

5. TAKE-OFF

(i) Ease the aircraft off at 80 to 85 knots IAS.

(ii) Commence to climb at 90 to 95 knots IAS. This is below the safety speed - see Part III para. 5.

(iii) Raise the undercarriage as soon as safely airborne and then, at a safe height, flaps (if down).

6. CLIMBING

(i) The recommended speed is 95 knots IAS.

(ii) No increase in speed or reduction of rpm should be necessary for cooling, but at an increased speed of 100 knots the rate of climb should still be adequate.

7. CRUISING

(i) The speed recommended for maximum range is 94 to 98 knots IAS.

(ii) Rich mixture power may be required to maintain the recommended speed, and will be necessary in very hot weather for cooling. In rich mixture better cooling may be obtained by flying at a higher speed than that recommended for maximum range; this should be done by increasing rpm and boost progressively, until satisfactory cooling is obtained. Speed should not be increased more than is essential for cooling as range is reduced at high speeds. In weak mixture no improvement in cooling should be obtained by flying faster than the speed recommended for maximum range. See Part III, para. 6[iv] and para. 2 of this Appendix.

8. TURNS, DESCENT ON TOW, CASTING OFF, ROPE DROPPING AND EMERGENCIES - See Part III.

PART IV

NOTES ON GLIDER PICK-UP BY TUG IN FLIGHT
(Applying to the Dakota/Horsa combination)

DESCRIPTIVE

(i) Tug equipment. A winch is installed in the tug aircraft and a steel wire cable wound on the winch drum passes down a pick-up arm which extends downwards at an angle from the port side of the fuselage. At the end of this cable a hook is attached. The equipment also embodies a cartridge-fired cable cutter enabling the glider and cable to be cast off in emergency. This cutter is operated by means of two push-buttons labelled GLIDER EMERGENCY RELEASE immediately above the pilot's head; to operate the cutter the two buttons must be pressed simultaneously. A safety switch is fitted forward of the rear fuselage door; this renders the push-buttons inoperative when set down and live when set up. The switch should be set down while adjustments are being made to the winch to protect the operator from blast should the push-buttons be operated inadvertently; it should be set up before pick-up and at all times in flight.

(ii) Ground Equipment. A pick-up station is erected on the ground consisting of two light poles, painted yellow, at a distance apart. A nylon rope loop is attached to the top of these poles by means of metal clips carrying small yellow flags to enable them to be seen from a distance. Attached to this loop is a length of nylon rope connected to the glider in the normal manner. Two yellow ground strips about 9 ft. x 3 ft. are placed, one at the base of each pole to enable the tug pilot to locate the station from a distance; they can also be used for signalling by setting them at pre-arranged angles.

GENERAL METHOD

(i) Pick-up. The glider is placed at an angle of about 10° to a line passing at right angles between the poles, with all kinks and excessive slack removed from the nylon rope, so that the glider is approximately 300 ft. behind and to one side of the station. The tug flies low over the station, leaving the glider on his left, so that the pick-up arm strikes the nylon loop, which slides down the arm and is engaged by the hook. The initial snatch shock is absorbed by the elasticity of the nylon rope and by the initial acceleration of the winch drum as the steel cable pays out. The drum is provided with a brake, previously set to come into action progressively and so retard the drum. As the drum slows down the glider is pulled forward until, when the drum is brought to rest, the glider (now airborne) is flying at the same speed as the tug.

(ii) After pick-up. When well clear of the ground, and with the length of nylon rope plus the 600 ft. to 900 ft. of steel cable (which unwound from the drum during pick-up) constituting the tow rope, the steel cable can be wound in by starting the electric motor on the winch and slowly winding it until the desired length of cable is obtained, or until the hook at the end of the cable is brought close inboard when the glider will be on tow at the end of nylon rope of normal length.

3. TECHNIQUE FOR THE DAKOTA PILOT WHEN PICKING UP THE HORSA GLIDER

(i) Checks: On receiving the pre-arranged signal from the ground, or glider, that the latter is ready for pick-up, the pilot should check with the winch operator that the safety switch is set up (live) and that the pick-up arm is lowered.

(ii) Approach and pick-up. A narrow circuit should be made so as to keep the station well in view. Speed on the circuit should be as near 110 mph IAS as can be maintained - this is to assist the winch operator in his work; the aircraft is then turned at right angles to the ground station. Just prior to the final turn-in for approach the propellers should be set to 2550 rpm and the aircraft should be put into a powered glide, using between 15" and 20" Hg. boost. The aircraft is now aimed at a point between the glider and the ground station and is allowed to accelerate in this powered glide up to the contact speed of 140 to 145 mph IAS. On this final approach the aircraft should be trimmed slightly nose heavy.

The lowest point in the flight path of the tug is reached approximately halfway between the glider and the station; at this point the climb is commenced and power is applied steadily by opening the throttles smoothly up to 48 ins Hg. boost; thus, the aircraft is in a climbing attitude over the station and full power is attained just after contact. This technique is important because, if the aircraft, is not accelerating at the moment of contact, considerable sink may be experienced.

(iii) Climb. On the subsequent climb, in no circumstances must the aircraft be flown at a speed below 105 mph IAS; the desired climbing speed being from 105/115 mph IAS. As soon as a safe height of about 500 ft. is reached the tug pilot can throttle back to normal climbing boost and rpm, but during climb no turns to the right must be made. If necessary gentle left-hand turns may be made; but below 500 ft. all turns should be avoided.

(iv) Winding in: Once a cruising height of not less than 1000 ft. above the terrain has been reached, the cable may be wound in as follows:

(a) The glider pilot should be advised by pre-arranged signal that this is to be done so that he can take up the correct position.

(b) The tug should be flown at 110 mph IAS while the cable is wound in.

(v) Casting off: The glider will cast off first and the tug crew should then disengage the nylon rope loop from the tow hook and secure it with the burden release (by means of the rope loop attached near the cargo door) preparatory to dropping it over the dropping area.

(vi) Checks before landing: Before landing the pilot must check with the winch operator that the pick-up arm is raised and secured.

(vii) Emergencies:

(a) In case of an incomplete pick-up after contact with the loop, the tug pilot should immediately assume maximum climb to not less than 1000 ft.

(b) If at any time after contact the tug pilot should get into difficulties, the glider and cable should be released by operating the GLIDER EMERGENCY RELEASE pushbuttons.

4. TECHNIQUE FOR THE HORSA PILOT WHEN BEING PICKED UP BY DAKOTA AIRCRAFT IN FLIGHT

(i) Before pick-up. After all pre-flight checks have been completed the crew are in position, and the glider is ready for pick-up the tug pilot should be given the pre-arranged signal, 'ready for pick-up'.

(ii) Take-off.

(a) Set all trimmer tabs neutral, check brakes unlocked, and hold the control column central.

(b) The glider will start to move very soon after the tug engages the nylon loop and will be airborne in about 250 to 400 ft.

(iii) Initial climb. As soon as the acceleration period is concluded i.e. as soon as the glider reaches the tug speed, the glider pilot should climb sharply to ensure that the cable, of which there may be upwards of a thousand feet between the tug and glider at this stage, does not sag and foul any obstructions on the ground; the pilot should, however, move the control column forward immediately he sees the sag is being taken up.

WARNING: Since the Dakota is fitted for towing from beneath the fuselage and not from the tail, care must be taken not to climb too high and thus permit the cable to foul the elevators or tail-wheel of the tug.

(iv) Emergency release. Except in extreme emergency the glider pilot should not cast off until a safe height of at least 1000 ft. is reached, since upwards of 1000 ft. of cable would be left dragging from below the tug.

(v) Position on climb and in level flight with long cable. On climb when well clear of the ground and in level flight, the glider should fly in any low tow position found comfortable. To ensure that the cable does not foul the tug, avoid flying too high.

(vi) Winding in the cable- When the tug signals that he is about to wind in the steel cable, the glider should fly slightly to the left of the tug approximately in line with the left-hand tail-tip. This is to ensure that the cable does not chafe unduly on the main pulley of the tug, as this is slightly offset.

(vii) Normal position on tow: After the cable has been close-hauled the glider should fly in a normal low-tow position, as defined in Part II.

(viii) Casting-off. Casting off should normally be carried out from the high tow position in the usual way, but the glider should not get high enough above the tug to result in the cable fouling the elevator or tail wheel.

AMENDMENT CERTIFICATE

Incorporation of an amendment list must be certified by inserting date of incorporation and initials below.

A.L. NO.	INITIALS	DATE	A.L. NO.	INITIALS	DATE
1	RW	26/7/44	11		
2	RW	26/7/44	12		
3	RW	26/7/44	13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		